Methods for calculating multileaf collimator (MLC) leaf trajectories to deliver intensity modulated radiation therapy (IMRT) are well established. The control software used by Elekta Oncology Systems requires leaf positions to be defined at a series of control points which are spaced at arbitrary intervals throughout the exposure. Leaves move linearly between the positions defined at the control points and hence leaf motion is a linear approximation to the planned trajectories. When many control points are used, very complex modulations can be defined accurately. If too few are used, dose errors are introduced which depend on the complexity of the modulation and the number of control points chosen. Proposed intensity modulations, of varying complexity, have been converted to trajectory plans where the number of equally spaced control points varied between 11 and 99. In each case the fluence map generated by the resulting leaf motions was computed, and this was quantitatively compared to the desired modulation by calculating the root mean square (RMS) error.

For the most complex modulation at the lowest number of control points the RMS error was 16.2 mu, but this fell to 2.5 mu as the number of control points was increased to 50. In no case was there any further significant reduction in the RMS error when the number of control points was increased above 50.

It is concluded that 50 control points are sufficient for practical IMRT delivered by the dynamic MLC technique.

This work was supported by Elekta Oncology Systems Ltd.